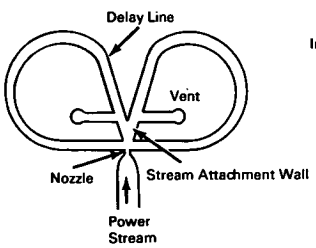
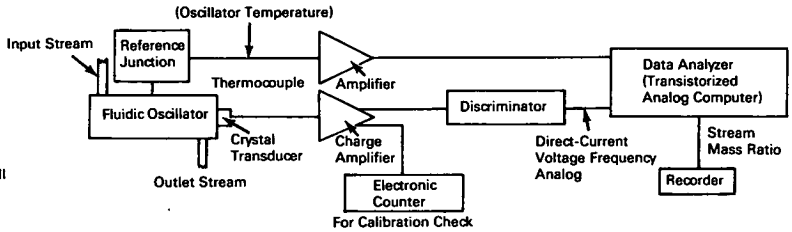
March 1967 Brief 67-10063

NASA TECH BRIEF

Fluidic Oscillator Used as Humidity Sensor



SCHEMATIC OF FLUIDIC OSCILLATOR



COMPLETE HUMIDITY SENSOR

A test program was undertaken to investigate the dynamics of hydrogen–oxygen fuel cell systems. In the type of system presently being studied, the water produced in the cells is removed in vapor form by a recirculating stream of hydrogen. Part of the test program consists of introducing controlled disturbances into the humid hydrogen stream that enters the fuel cell and studying the effects of these disturbances.

To study the effects on the fuel cell water removal processes, it is necessary to know, on a continuous basis, the humidity (steam-to-hydrogen mass ratio) of the hydrogen stream leaving the fuel cell. The instrument to be used for measuring the recirculating stream humidity, in addition to being a continuous reading device, has to have a certain speed of response. Since a measurement technique or a humidity transducer with the required speed of response could not be found, an instrument based on a fluid oscillator concept was designed and developed.

Complete details of this effort are contained in a technical memorandum, "Use of a Fluidic Oscillator as a Humidity Sensor for a Hydrogen–Steam Mixture," by Paul R. Prokopius, Lewis Research Center, No. E-3413, May 1966.

A test program was conducted on the instrument to define its steady state and transient performance. The test program also resulted in a determination of the failure modes and accuracy limitations of the instrument. An analog computer program that serves as a data analyzer and converts the humidity sensor from an indirect to a direct reading instrument was also developed. The program converts the normal instrument output of frequency of oscillation at a given temperature and pressure directly to a steam-to-hydrogen mass ratio reading.

The calibration accuracy was approximately ±2 percent in mass ratio, over the mass ratio calibration range of 0.8 to 2.1. Analysis of frequency response data indicated that the response of the sensor was flat at least to the 3 cps limit of the test apparatus.

Note:

Copies of the technical memorandum are available from:

Technology Utilization Officer
Lewis Research Center
21000 Brookpark Road
Cleveland, Ohio 44135
Reference: B67-10063

Patent status:

No patent action is contemplated by NASA.

Source: P. R. Prokopius
(Lewis-340)

Category 05